HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
RADIO AND TELEVISION

WILLIAM F. HAMMETT, P.E.
DANE E. ERICKSEN, P.E.
GERHARD J. STRAUB, P.E.
STANLEY SALEK, P.E.
ROBERT D. WELLER, P.E.
DANIEL G.P. MANSERGH
MARK D. NEUMANN

Consultants to the Firm
ROBERT L. HAMMETT, P.E.
EDWARD EDISON, P.E.

ELECTRONICALLY FILED

May 17, 2000

Ms. Magalie Salas
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Dear Ms. Salas:

On behalf of Hammett & Edison, Inc., Consulting Engineers, we are filing electronically our comments to MM Docket 00-39, concerning a Review of FCC Rules and Policies Affecting the Conversion to Digital Television.

Sincerely,

/s/ Dane E. Ericksen

en

Enclosures

e-mail: **dericksen@h-e.com**
US Mail: **Box 280068 • San Francisco, California 94128**
Delivery: **470 Third Street West • Sonoma, California 95476**
Telephone: **707/996-5200 San Francisco • 707/996-5280 Facsimile • 202/396-5200 D.C.**

MM Docket 00-39
Review of DTV
Rules and Policies

Comments of
Hammett & Edison, Inc.
Consulting Engineers

May 17, 2000

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Review of the Commission's	)	MM Docket No. 00-39
Rules and Policies Affecting the	)	
Conversion to Digital Television	)	
	)	

To: The Commission

Comments of Hammett & Edison, Inc.

The firm of Hammett & Edison, Inc., Consulting Engineers, respectfully submits these comments in the above-captioned proceeding relating to the Commission's Review of DTV rules and policies. Hammett & Edison, Inc. is a professional service organization that provides consultation to commercial and governmental clients on communications, radio, television, and related engineering matters.

I. Qualifications of Hammett & Edison, Inc.

1. Hammett & Edison, Inc. is well qualified to make comments on this matter, having been one of the parties petitioning the Commission to reconsider certain aspects of the Fifth and Sixth Report and Orders to MM Docket 87-268. Since that June 16, 1997, filing, Hammett & Edison has continued to work with Mass Media Bureau ("MMB") and Office of Engineering and Technology ("OET") staffs in an effort to match the Commission's "baseline" populations for the noise-limited, interference-free coverage of existing National Television System Committee ("NTSC") stations and digital television ("DTV") allotments. Page 2 of the August 10, 1998, Public Notice, "Additional Application Processing Guidelines for Digital Television (DTV)," requires that parties conducting OET-69 style interference studies certify the accuracy of their computer programs, and this can be done only by careful examination of the source code used by OET staff to develop the DTV Table of Allotments; this, in turn, has resulted in many telephone consultations with Commission staff, and the discovery of certain technical inconsistencies.

2. At Paragraph 116 to the April 21, 1997, Fifth Report and Order to MM Docket 87-268 ("Fifth R&O"), the Commission stated it would hold a "periodic review every two years until the cessation of analog service" in order to ensure the smooth introduction of DTV and the timely recovery of spectrum upon the demise of analog television service. That paragraph

further went on to state that "During these reviews, we will address any new issues raised by technological developments, necessary alternations in our rules, or other changes necessitated by unforeseen circumstances." That two-year period presumably tolled in April of 1999, with no Commission action. Four months later, on August 26, 1999, Hammett & Edison took the initiative and filed its biennial review comments, pointing out several technical problems with the Commission's adopted methodologies and policies that had become apparent in over two years of preparing DTV applications, many of them involving "maximized" DTV facilities.[1]

3. While Hammett & Edison applauds the review now initiated, we are disappointed that the Notice of Proposed Rule Making ("NPRM") is silent on all of the technical issues raised in our August 1999 filing, which are both significant and serious. The failure to include the technical problems documented in our earlier filing (and repeated here, hopefully with better success) means that parties reading the NPRM were not put on notice regarding issues such as the depression angle calculation problem, the Error Code 3 ("EC3") problem, and the bizarre assumption that DTV receiving antennas for VHF low-band, VHF high-band, and UHF will have significantly better performance than their NTSC counterparts, to name a few. This is regrettable.

4. As with our August 1999 filing, some of the issues raised in these comments have already been brought to the attention of the FCC in other forums, and it is recognized that the FCC may have declined to address or correct some of them until the promised review process was initiated. However, the process has now commenced, and we respectfully submit that ALL of the technical issues raised in these re-filed comments address "new issues raised by technological developments, necessary alteration of the Commission's rules, or other changes necessitated by unforeseen circumstances." We specifically wish to point out that the material on the chronic nature of the EC3 problem is <u>new information</u> that the Commission must address if this "DTV Review" proceeding is to be valid. Therefore, we trust that the Commission will not attempt to suppress discussion of these technical problems by arguing that they are beyond the scope of the NPRM; to the contrary, all of the issues addressed in these re-filed Hammett & Edison comments are a direct and foreseeable outgrowth from the stated purpose of the NPRM.

II. Severity of Error Code 3

1 Those comments are now available on the Commission's Electronic Comment Filing System ("ECFS"), under MM Docket 87-268.

5. The FCC methodology for DTV coverage and interference studies involves creating a large number of 4-square-kilometer cells within a station's protected contour, as derived using the F(50,50) and F(50,10) curves and the station's conventional 3 to 16 kilometer average elevations. As many cells are created as are necessary to fill up a station's F(50,50) NTSC contour, or F(50,90) DTV threshold contour; this typically involves 1,000 to 2,500 cells. Each cell's reference coordinates are then determined based on the population distribution within the cell (a cell with zero population has its reference point at the geometric center of the cell). If the signal strength at a cell's reference coordinates is predicted to be above the station's NTSC or DTV threshold, then all the population within that cell is counted towards the station's noise-limited service. Additionally, such cells are then checked for interference from existing stations and other DTV stations/allotments. The population within cells passing both criteria establishes the station's noise-limited, interference-free service, which, for DTV, was hoped to equal or exceed the station's existing NTSC service. Unfortunately, when the FCC adopted the Longley-Rice algorithm as mandatory for DTV coverage and interference calculations, it adopted a propagation model that does not always successfully calculate the field strength at a cell. The FCC initially believed this to be a minor problem, but experience with the NTIS version of the Longley-Rice model now suggests that this problem is chronic, and that fine-tuning of the OET-69 methodology may be in order.

6. According to the program software, Error Code 3, or "EC3," indicates that internal program calculations show parameters are out of range[2] and that the reported results are "dubious or unusable."[3] The Commission's decision in developing the DTV Table of Allotments was that cells returning EC3 for a "desired" signal would 1) have service (*i.e.*, to have a signal strength above the pertinent DTV or NTSC threshold level) and 2) be presumed to be interference-free (*i.e.*, not checked for interference). For cells where an "undesired" signal returned EC3, that potentially interfering signal was ignored. In the Sixth Reconsideration Order, the FCC indicated that this policy should be continued for prospective, maximization studies.[4]

---

2 Page 70 of "A Guide to the Use of the ITS irregular Terrain Model in the Area Prediction Mode," U.S. Department of Commerce National Technical Information Service Report No. PB82-217977, April, 1982.

3 February 23, 1998, Memorandum Opinion and Order on Reconsideration of the Sixth Report and Order ("Sixth Reconsideration Order"), at Paragraph 179.

4 Sixth Reconsideration Order, at Paragraph 182.

7. Our analysis of EC3 for the 1,601 DTV allotments in the contiguous United States (*i.e.*, excluding Alaska, Hawaii, Puerto Rico, Guam, and the Virgin Islands) reveals the following prevalence:

Percentage of DTV Allotments	Percent of Population in Cells with EC3
2.8%	<0.1%
7.1	0.1 – 1
16.0	1 – 5
16.0	5 – 10
23.4	10 – 20
28.1	20 – 50
6.5	50 – 90
0.1	> 90

8. On the average, 18.2% of a DTV allotment's population fell in EC3 cells, which is troubling. It makes little sense to have a 2% *de minimus* criteria for DTV stations, and a 0.5% *de minimus* criteria for NTSC stations, when the underlying prediction model has an average uncertainty of 18%. Under the FCC's *de minimus* policy, a modifying DTV station is generally allowed to cause up to 2% additional interference to an existing NTSC station or to a DTV allotment on the presumption that such additional interference is acceptably minor, *i.e., de minimus*. NTSC stations seeking to modify their facilities are held to a more restrictive criteria, where the loss in population served must be less than 0.5% of the DTV station's predicted noise-limited, interference-free population. Figure 1A shows the OET-69 coverage for a Los Angeles UHF DTV allotment. At first glance, the white areas, representing cells where 1) the cell was predicted to have a signal strength equal to, or greater than, the station's DTV threshold, and 2) the cell was predicted to receive interference from any other station. However, when the Longley-Rice EC3 cells are added, as shown in Figure 1B, things no longer look so good: 30.7% of the cells, containing 9.1% of the allotment's potential population, or well over a million persons, are EC3 cells.

9. Similar EC3 problems exist for the UHF allotment assigned to a West Virginia station. Figure 2A shows the coverage using the FCC method, that is, where EC3 cells are assumed to have interference-free service, and therefore shown as white (no symbol) areas, and Figure 2B shows the coverage with EC3 cells displayed. In this station's case, the EC3 cells represent 59.7% of the station's coverage area and 57.6% of the station's population.

10. And these stations are not unusual with regard to the EC3 problem. Figure 3 shows the prevalence of EC3 cells for an OET-69 <u>interference</u> study pertaining to a DTV allocation in western Pennsylvania, and it can be seen that the vast majority of the cells return EC3.

For an OET-69 interference study, as opposed to an OET-69 coverage study, the protected contours of all stations with one or more cells within the cell-to-transmitter distances given in Table 7 of OET-69 must be studied.

11. It should be noted that EC3 cells can be defined in two different ways: only count EC3 cells as those cells that return EC3 for a desired signal, or also include cells where EC3 is generated for an undesired signal, if the undesired signal could affect the cell status. For example, if a cell has its desired signal above its NTSC or DTV threshold and is EC3-free, but there is an interfering signal that returns EC3, then that cell could be counted as an EC3 cell, because the indeterminate status of the interfering signal has the potential to change the cell's status. On the other hand, if a cell has a desired signal that is EC3-free but calculates to below the desired signal's NTSC or DTV threshold, then that cell would not be counted as an EC3 cell if one of more interferors return EC3, because cells that are below the desired signal's NTSC or DTV threshold are not entitled to protection, and therefore an EC3 condition for one or more undesired signals could not affect the cell's status. If this more restrictive EC3 definition is used, then the nation-wide average drops to 7.0% but this is still a troubling uncertainty and much greater than the *de minimus* criteria.

III. Miscalculation of Depression Angles

12. Another problem involves miscalculation of the depression angle from a transmitting antenna to a cell. Due to a source code error, the FCC OET-69 computer program calculates the depression angle to a cell based on the transmitting antenna's height above ground level (AGL) rather than height above mean sea level (AMSL). For stations that obtain their height from tall buildings or tall towers, this does not introduce much of an error. However, for stations that obtain their height from tall mountains, a significant error can be introduced. For example, the TV stations at Mt. Wilson, near Los Angeles, have typical center-of-radiation heights of only 91 meters AGL but 1,828 meters AMSL. This results in depression angle errors of 2.5° to 3.0° to cells in the Los Angeles basin. When combined with the fact that most DTV allotments are UHF, and that UHF antennas typically have elevation pattern half-power beam widths ("HPBW") of 1.5°–2.5°, then a 2.5°–3.0° error in the calculation of depression angle can be significant.

13. Unlike the EC3 problem, which was the result of an intentional decision that experience has now shown may need to be revisited, the depression angle problem was clearly the result of a source coding error and so was unintentional. Surprisingly, when the Commission was alerted to this problem, in December 1998, rather than fixing the problem (a simple correction

of one line of the source code), giving a Public Notice to that effect, and processing all subsequent applications based on correctly calculated depression angles, the FCC instead continues generally to use the flawed source code. As shown by Figure 4, depicting a portion of actual source code being used by the Commission's OET, there is now a "mod4" version of the source code that allows depression angles to be correctly calculated, if so requested by the Commission engineer running the study; however, it is believed that normally the Commission will use the uncorrected source code and so intentionally miscalculate the depression angles to cells under study. This practice was pointed out by the undersigned Senior Engineer (also the moderator of the morning and afternoon *Technical Regulator Hot Topics for Broadcasters* sessions) at the recent NAB Convention during the "Ask the FCC" panel, in response to a request from the MMB representative to let him know about any processing problems. However, the other panelist, representing OET, expressed an opinion that the depression angle calculation method could not be changed because the period for Reconsideration Petitions had long since passed and changing the calculation methodology would be "unfair" to pending applicants. It is noted, however, that nowhere in the Fifth or Sixth R&Os, or in the two Reconsideration Orders, or in OET-69, were the formulas for the calculation of depression angles discussed, and there was certainly no indication that the FCC had intentionally planned to miscalculate depression angles. Rather, the depression angle problem was discovered by this firm while examining the actual source code used by OET to develop the DTV Table of Allotments, which is available on the FCC OET web site at http://www.fcc.gov/oet/dtv. It is believed that a similar source code is presently being used by MMB staff to verify OET-69 interference studies submitted in support of non-checklist[5] DTV applications and NTSC applications.

14. To appreciate the magnitude of the problem, Figure 5A shows a plot of depression angles to Census population centroids within 160 kilometers of Mt. Wilson and having line of sight to a center-of-radiation height of 1,817 meters AMSL/80 meters AGL (these are the actual heights for a DTV station at Mt. Wilson). Figure 5B shows those same depression angles based on the incorrect FCC method. Obviously, there is a significant difference and it is again questionable for the FCC to be worrying about 2% and 0.5% *de minimus* interference when such errors in the calculation of depression angles continue to be introduced.

IV. Actual Rather Than Generic Elevation Patterns

5 "Non-checklist" applications are those that cannot answer "yes" to questions 1 through 5 of Section V-D ("DTV Broadcast Engineering Data") of FCC Form 301 (for commercial DTV stations) or FCC Form 340 (for noncommercial DTV stations).

15. OET-69 provides generic UHF NTSC and DTV elevation patterns; these are shown in Figures 6A (for NTSC) and 6B (for DTV). Since these patterns were used to develop the DTV Table of Allotments and the "baseline" noise-limited, interference-free service for NTSC stations and DTV allotments, their use is necessary if current OET-69 interference studies are to replicate the FCC baseline populations. Of course, accurately replicating the FCC baseline populations is critical for determining whether a proposed facility will cause no more than *de minimus* new interference. There are two items to note regarding the OET-69 generic UHF elevation patterns: 1) Table 8 of OET-69 provides values only from 0.75° below the horizontal to 10° below the horizontal (and note that a positive beam tilt indicates an angle *below* the horizontal; that is, a beam tilt of 90° means straight down, and a beam tilt of -90° means straight up), and 2) an electrical beam tilt ("EBT") of 0.75° for both the NTSC and for the DTV elevation patterns is presumed. Unfortunately, many NTSC stations on tall mountains have more than 0.75° EBT, and many employ a combination of electrical and mechanical beam tilts. Figures 7A and 7B demonstrate why good designs often employ both electrical and mechanical beam tilts. Figure 7A shows a transmitting antenna with a HPBW of 3.6° (corresponding to a Dielectric TFU-18GTH antenna) and with 2° of electrical beam tilt. The site is for a DTV station in the California Central Valley, on a 1,036-meter AMSL mountain approximately 48 kilometers east of the station's principal community, which has an elevation of about 91 meters AMSL. It can be seen from Figure 7A that 2° of EBT would provide reasonably good coverage of the population distribution (and also that the 0.75° of EBT presumed by OET-69 would not; indeed, an EBT of only 0.75° would result in most of the station's power being radiated hundreds to thousands of feet over the heads of potential viewers). However, Figure 7B, which adds 1° of mechanical beam tilt ("MBT") toward 250°T, the direction to the major population center, will result in almost a doubling of the ERP toward that population center, with no increase in transmitter power output. The mechanical beam tilt also improves coverage to population centers at 120°T, 150°T, and 165°T from the transmitter site.

16. However, the inclusion of MBT means that the main beam and horizontal plane azimuth patterns are no longer the same, as shown in the attached Figure 8A; the solid line is the main-beam azimuth pattern (corresponding to the Dielectric TLP-M pattern at 270°T) while the dashed line is the horizontal plane azimuth pattern. Even greater departures are possible; for example, Figure 8B shows the main-beam versus horizontal plane patterns for a Mt. Wilson UHF station with 1.6° of EBT and 0.6° of MBT toward 225°T. The main-beam pattern is a Dielectric S180 at 172°T, whereas the horizontal plane pattern has its maximum

at 92°T. The horizontal plane pattern is important because it is that pattern that Section 73.685(e)(2) of the NTSC Rules, and Section 73.625(c)(3)(ii) of the DTV Rules, states must be provided in applications that propose a directional transmitting antenna. Further, the Rules state, "Where mechanical beam tilt is intended, the amount of tilt in degrees of the antenna vertical axis and the orientation of the downward tilt with respect to true North must be specified, and the horizontal plane pattern must reflect the use of mechanical beam tilt." Thus, both the NTSC and DTV Rules are clear 1) that it is the horizontal plane azimuth pattern and not the main-beam azimuth pattern that is to be used and 2) that the horizontal plane azimuth pattern must reflect the effect of MBT when used. In other words, this is not an ambiguously worded rule, requiring interpretation by FCC staff. Finally, it should be noted that the magnitude of the effect of MBT on the main-beam pattern depends on 1) the elevation pattern shape; 2) the amount of EBT; 3) the amount of MBT; and 4) the direction of the MBT.

17. Unfortunately, some applications proposing MBT as well as EBT have been specially studied by FCC staff using the main beam pattern (which neither the Rules nor Form 301/340 nor OET-69 require even be submitted), using correctly calculated depression angles, and using either the actual elevation pattern or a customized version of the OET-69 generic elevation pattern, made symmetric around its main beam. Although Hammett & Edison agrees these steps result in more accurate interference studies, obvious fairness issues are raised by requiring such additional studies selectively for some applications but not for others. In one case involving a minor-change amendment to a UHF NTSC station that wanted to relocate to a new site 1.7 kilometers from its present site, and which proposed a combination of EBT and MBT with a main-beam peak visual ERP in excess of 4,000 kW, TV Branch staff insisted on studying the application using the actual EBT and MBT, a symmetric version of the generic elevation pattern, and correctly calculated depression angles to OET-69 cells. This resulted in months of delays, significant additional expense to the licensee for engineering and legal fees, and ultimately a 2.4 dB reduction in ERP. What was so frustrating to this firm is that the Commission staff agreed that, if the application was studied based on the horizontal plane pattern (as specified in the FCC Rules), the generic UHF elevation pattern (as given in OET-69), and incorrectly calculated depression angles (as was done by the FCC when it developed the DTV Table of Allotments), then less than 0.5% (and therefore *de minimus*) new interference was predicted to a nearby co-channel DTV allotment. Since the station was moving because it was losing its existing site, the FCC insistence that the requested ERP be reduced was accepted so as to obtain the urgently needed construction

permit. However, the transmitter, transmission line, and antenna were sized so as to be capable of operating at the originally requested power level, in anticipation that the unusual processing of the station's application would be revisited at a later date, when the criteria for the processing of NTSC modifications had become more firmly established. If the Commission wishes to treat NTSC or DTV applications specifying mechanical as well as electrical beam tilt differently from the procedures specified in the current version of the FCC Rules and OET69, then this should be included in the instant proceeding, so as to allow all interested parties to comment.

18. Hammett & Edison believes that the Commission could make a major step in fixing this portion of OET-69 by allowing, but not requiring, use of the actual elevation patterns employed by existing or proposed stations when making OET-69 interference studies. Although it is realized that the Commission's engineering database regrettably does not include elevation patterns, this omission could be overcome by allowing applicants wishing to use actual elevation patterns to submit those patterns when used in place of a generic elevation pattern. This option should apply for both the proposed facilities and for the facilities of other stations close enough to require study. Also, and as previously discussed, the Commission should require new applications needing to submit a detailed OET-69 style interference study (*i.e.*, all minor-change NTSC applications and all DTV applications that, for whatever reason(s), are not "checklist" applications) to base their study on correctly calculated depression angles.

V. UHF Taboo Ratios Too Lenient for Strong-Signal Areas

19. At the "DTV Transmission Systems" session on April 20, 1999, of the NAB Convention, Mr. Stanley Salamon of the Advanced Television Technology Center ("ATTC") presented a paper, "DTV Taboo Channel Interference into NTSC at High Power Levels," suggesting that in strong signal areas the desired-to-undesired ratios ("D/U") adopted by the FCC for protection of NTSC stations on taboo channels to a DTV allotment were too lenient by an astonishing 20 to 23 dB. This suggests that NTSC stations in the unfortunate position of having one or more DTV allotments on their taboo channels may be in for difficult times if those DTV stations are 1) in an area that is a "strong signal" area for the NTSC station and 2) in an area that is heavily populated. For example, one San Francisco UHF NTSC station not located on the Sutro Tower in the Twin Peaks area of San Francisco, home to ten NTSC stations, has taboo channel relationships to no fewer than six of the ten DTV channels allocated to the NTSC stations on the Sutro Tower. If, in fact, the Sixth R&O significantly underestimated the NTSC taboo channel ratios, then reception of this NTSC channel over a wide portion of San Francisco may well become difficult or impossible.

20. Even if the ATTC findings prove to be a false alarm, NTSC stations with DTV allotments on their taboo channels would appear to need to keep a wary eye on any non-checklist applications that a taboo-channel DTV station might file, especially if such modified facilities would result in the DTV station being constructed in a heavily populated area. Why? Because the OET-69 study may well under-predict the signal levels at the steep depression angles around the DTV site, due to use of a generic elevation pattern that probably does not accurately model the actual elevation pattern. Especially if a relatively low-gain antenna with a wide elevation pattern HPBW is used, or if significant amounts of null fill are employed, then the D/U ratios to cells near the proposed DTV station may be incorrectly calculated, assuming, of course, that they are not EC3 cells that give the maximizing DTV station "free parking." For example, Figure 9 compares the elevation pattern of an Andrew ALP-8 elevation pattern with 1.5° EBT to the OET-69 UHF DTV elevation pattern. It can be seen that use of the actual elevation pattern rather than a generic one would be desirable for application processing purposes, in order to more accurately calculate actual D/U ratios between protected and interfering signals.

VI. Same Receiving Antenna Patterns for NTSC and DTV OET-69 Interference Calculations

21. As shown by Figures 10A, 10B, and 10C, examination of the FCC source code reveals that the FCC assumed different receiving antenna performance for VHF low-band, VHF high-band, and UHF receiving antennas depending on whether the antenna is receiving an NTSC or DTV signal.[6] This is questionable, as clearly few viewers will erect separate receiving antennas for NTSC and for DTV; rather, most viewers will use a single antenna to receive both signals. The off-axis (front-to-back ratio) of the presumed DTV receiving antennas are higher than the corresponding NTSC receiving antenna, as follows:

	low-band VHF	high-band VHF	UHF
rejection improvement compared to NTSC receive antenna:	4 dB	6 dB	8 dB

22. The only apparent explanation for the different (and better performing) receiving antennas assumed for DTV is that this was the only way the Commission could come up with a DTV Table of Allotments that would meet desired replication levels for the existing coverage of NTSC stations. Now that a finalized DTV Table of Allotments exists, it would be appropriate for the Commission to specify just one receiving antenna pattern for low-band VHF, one pattern for high-band VHF, and one for UHF, when making OET-69 interference studies.

Blanket Waiver for NTSC Stations with Upper-Adjacent DTV Assignments and a Common Transmitting Antenna

23. Because of the difficulty in obtaining local or FAA approvals for new broadcast towers, many NTSC TV stations that received an adjacent-channel DTV allotment are resorting to a combined, dual-channel transmitting antenna. Such an approach allows use of a single transmission line and single transmitting antenna, thus minimizing the tower loading and often allowing use of an existing tower. However, this places a severe requirement on the diplexer used to combine the NTSC and DTV signals. For the N+1 case, that is, where the DTV channel is one channel above the NTSC channel, the effect of the combining filter may result in the NTSC signal not fully meeting the group delay requirement of Section 73.687(a)(3) of the FCC Rules, especially for the top portion of the NTSC video passband;

---

[6] It should be noted that this problem was raised in the Hammett & Edison Petition for Reconsideration to the Fifth & Sixth R&Os. However, unlike the several other Hammett & Edison items that the resulting Reconsideration Order did address, the receiving antenna problem was not among them.

that is, from approximately 3.9 to 4.2 MHz above the visual carrier. The attached Figure 11 documents the problem.

24. Group delay errors caused by an N+1 combiner may be capable of being canceled out by introducing a reciprocal group delay error in the NTSC exciter; however, this may require a custom surface acoustic wave (“SAW”) filter, which can require several weeks, if not months, to obtain. A waiver to allow temporary operation with out-of-tolerance group delay has already been obtained for an N+1 situation for a West Coast NTSC station, and we note that an out-of-tolerance group delay characteristic has no out-of-band interference potential to other stations or services. Rather, its effect is confined entirely to the transmitting station’s picture quality, and even then the impact is minimal on consumer-grade television receivers so long as the group delay characteristics between zero and 3.9 MHz of the visual carrier are within tolerance.

25. Rather than require many individual waiver requests for operation with group delay characteristics not entirely meeting Section 73.687(a)(3) of the FCC Rules, we suggest that the Commission consider issuing a public notice announcing a “blanket waiver,” automatically applying to NTSC/DTV stations with an N+1 channel relationship and using a common transmission line/antenna. We recommend that this blanket waiver allow departure from the required group delay characteristics for video frequencies between 3.9 and 4.2 MHz above the visual carrier for up to a six-month period, if documenting entries are made in the station log.

Interpretation of Section 73.622(f)(5) Requested

26. Section 73.622(f)(5) of the FCC Rules allows a DTV station to request a greater effective radiated power (“ERP”) than would otherwise be allowed for its effective height (*i.e.*, Sections 73.622(f)(6)(i) for VHF low band, 73.622(f)(7)(i) for VHF high band, and 73.622(f)(8)(i) for UHF), if necessary to “provide the same geographic coverage area as the largest station within their market.” However, clarification is needed regarding exactly how the “same geographic coverage” is to be determined. One approach would be to require that a “superpower” DTV station’s F(50,90) DTV contour (dipole-adjusted for UHF stations) must be everywhere within the DTV contour of the selected same-market station.

27. The attached Figure 12 demonstrates this problem. According to the 1999 *Television Factbook*, the Colorado Springs-Pueblo, Colorado, market consists of four TV stations: KKTV, N11/D10; KOAA-TV, N05/D42; KRDO-TV, N13/D24; and KXRM-TV, N21/D22.

KOAA-TV was allotted “superpower” DTV facilities of 1,000 kW ERP at 396 meters HAAT, since a UHF DTV station at a 396-meter effective height would normally be limited to 780 kW. In contrast, KXRM-DT received 75.1 kW ERP at 656 meters HAAT; Section 73.622(f)(8)(ii) would permit 279 kW ERP for that station’s presumed effective height of 656 meters (and again, of course, assuming that no greater than *de minimus* new interference would be caused). If KXRM-DT decides to try and maximize its DTV coverage to better match the coverages or KKTV-DT, KRDO-DT, and KOAA-DT, and assuming that there are no interference issues, what is the limiting ERP that KXRM-DT could request? Is it a coverage that is entirely within the DTV contour of one of the three other stations in the market? Or is it this coverage expanded in certain directions by the ERP that would otherwise be allowed for the station’s effective height? The latter interpretation seems most logical.

28. If the allowable ERP is to be based on a choice between matching the coverage of another station in the market in a particular direction or using the ERP allowed for the maximizing station’s effective height, is that effective height to be based on the radial in question, or is it to be based on the effective height reported at Item 8 of Section III-D of FCC Form 301; *i.e.*, the station’s effective height based on an 8-, 24-, or 72-radial average?

VII. DTV Principal Community Coverage

29. If a principal community, or “City Grade,” DTV contour needs is created the Commission should clarify that for UHF DTV stations, the City Grade contour must have the dipole factor applied (thus causing the DTV City Grade contour to range from 52.7 dBu at Channel D14 to 57.3 dBu at Channel D69). Additionally, fairness demands that this provision not be applied retroactively to permitted or licensed DTV stations.

VIII. Summary

31. Hammett & Edison urges the Commission to use the DTV Review process to fix these identified inconsistencies and/or errors, newly evolved technical problems, and now timely clarifications of how maximizing DTV stations should determine what greater ERP they can request, assuming that such greater power can be shown to cause no more than *de minimus* new interference. Of course, all permits and licenses already granted should be “grandfathered,” but it does not serve the public interest, the interests of broadcasters, or the interests of the FCC to continue use of regulatory systems based on known problems.

32. The following figures or exhibits have been prepared as a part of these MM Docket 00-39 DTV Review comments:

1. EC3 prevalence for Los Angeles DTV allotment
2. EC3 prevalence for West Virginia DTV allotment
3. EC3 prevalence for Pennsylvania-area NTSC stations and DTV allotments
4. FCC source code addressing EC3 problem
5. Depression angle plots
6. Plots of generic elevation patterns
7. Elevation HPBW versus depression angle plots
8. Horizontal plane versus main beam azimuth patterns
9. ALP-8 elevation pattern versus OET-69 generic elevation pattern
10. NTSC and DTV receive antenna patterns
11. Group delay problem for N+1 combiners
12. Map showing allocated coverages for the Colorado Springs-Pueblo market DTV stations.

Respectfully submitted,

/s/ William F. Hammett, P.E.
President

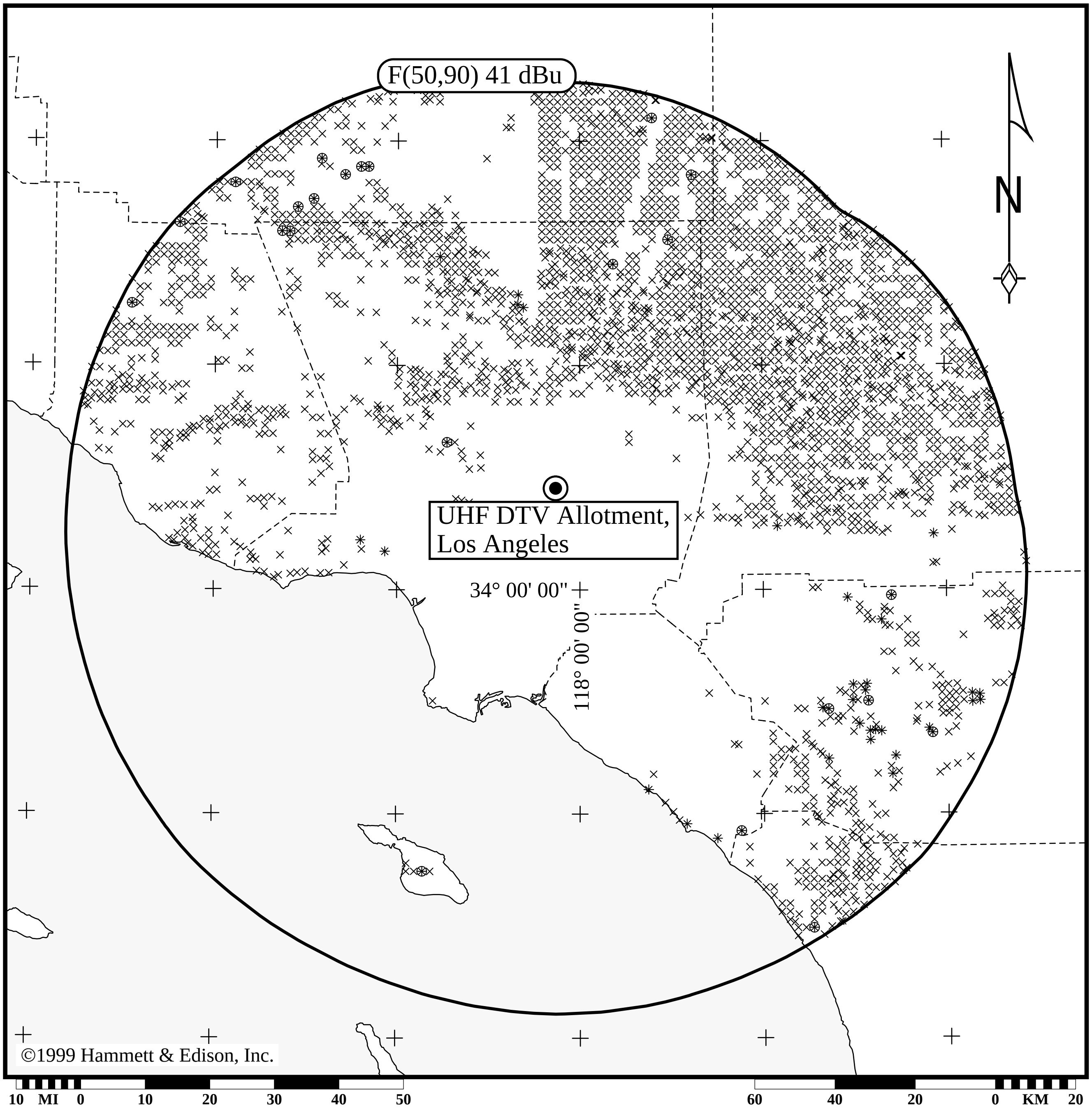
/s/ Dane E. Ericksen, P.E.
Senior Engineer

May 17, 2000

Hammett & Edison, Inc.
Consulting Engineers
Box 280068
San Francisco, California 94128-0068
707/996-5200

H&E Comments: MM Docket 87-268 • Biennial Review

OET-69 Coverage for a Los Angeles, California, UHF DTV Allotment (without EC3 Cells)



Map data taken from Sectional Aeronautical Charts, published by the National Ocean Survey. Geographic coordinate marks shown at 30-minute increments.

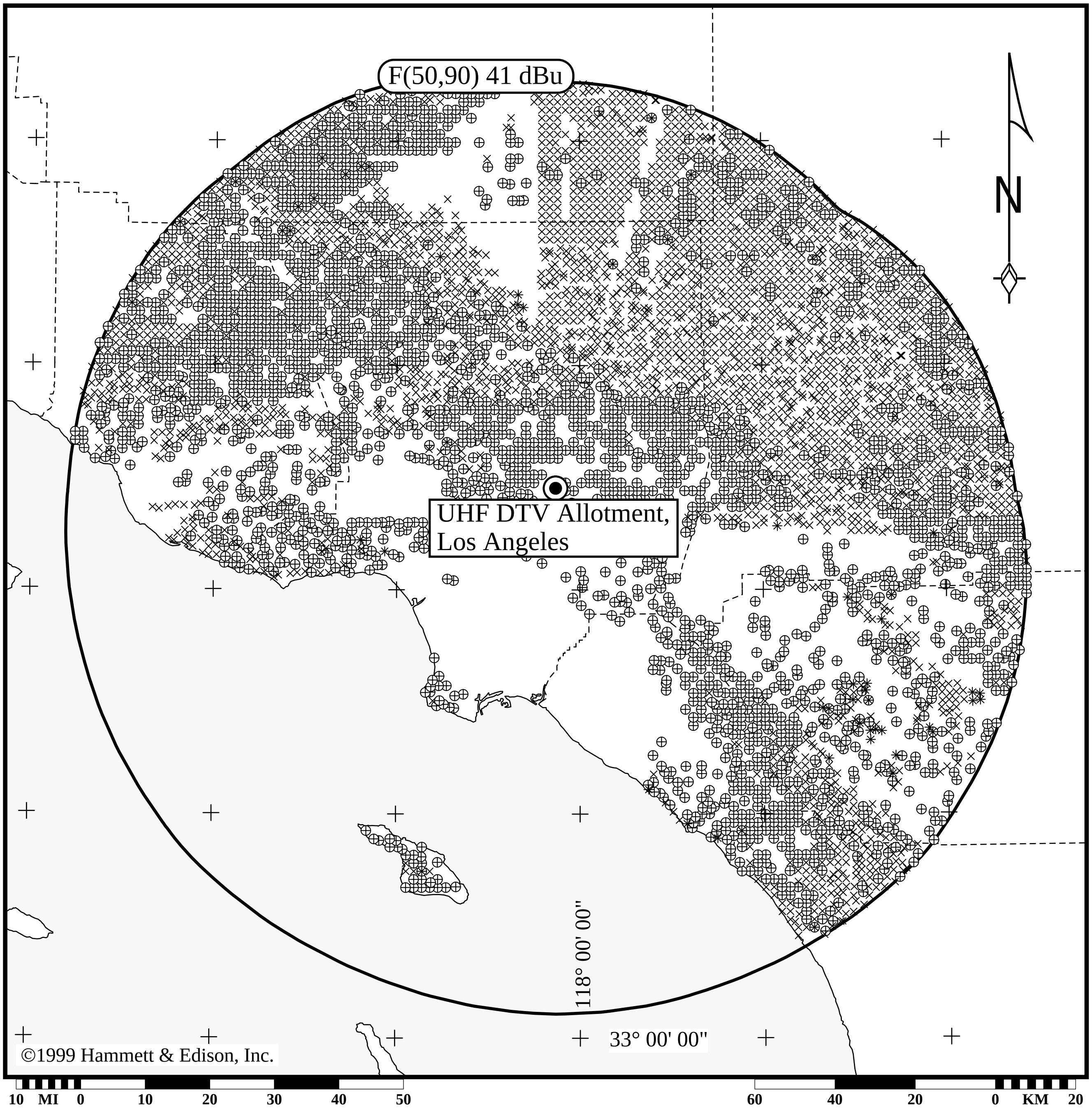
× = No Signal (below threshold)
⁎ = Interference (with population in cell)
⊛ = Interference (without population in cell)

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

990627
Figure 1A

H&E Comments: MM Docket 87-268 • Biennial Review

OET-69 Coverage for a Los Angeles, California, UHF DTV Allotment (with EC3 Cells)



Map data taken from Sectional Aeronautical Charts, published by the National Ocean Survey. Geographic coordinate marks shown at 30-minute increments.

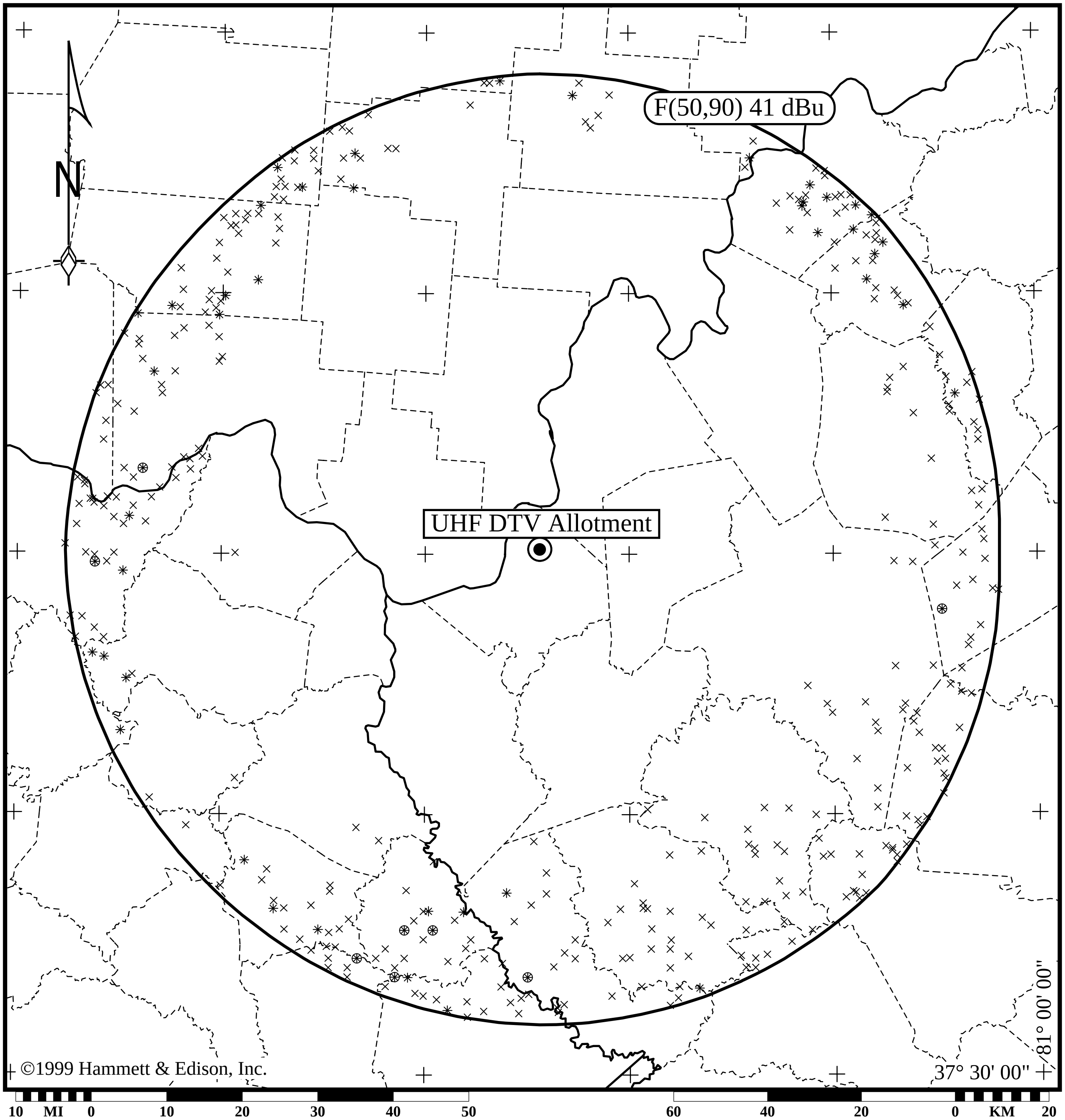
× = No Signal (below threshold)
∗ = Interference (with population in cell)
⊛ = Interference (without population in cell)
⊕ = Longley-Rice error cell

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

990627
Figure 1B

H&E Comments: MM Docket 87-268 • Biennial Review

OET-69 Coverage for West Virginia UHF DTV Allotment (without EC3 Cells)



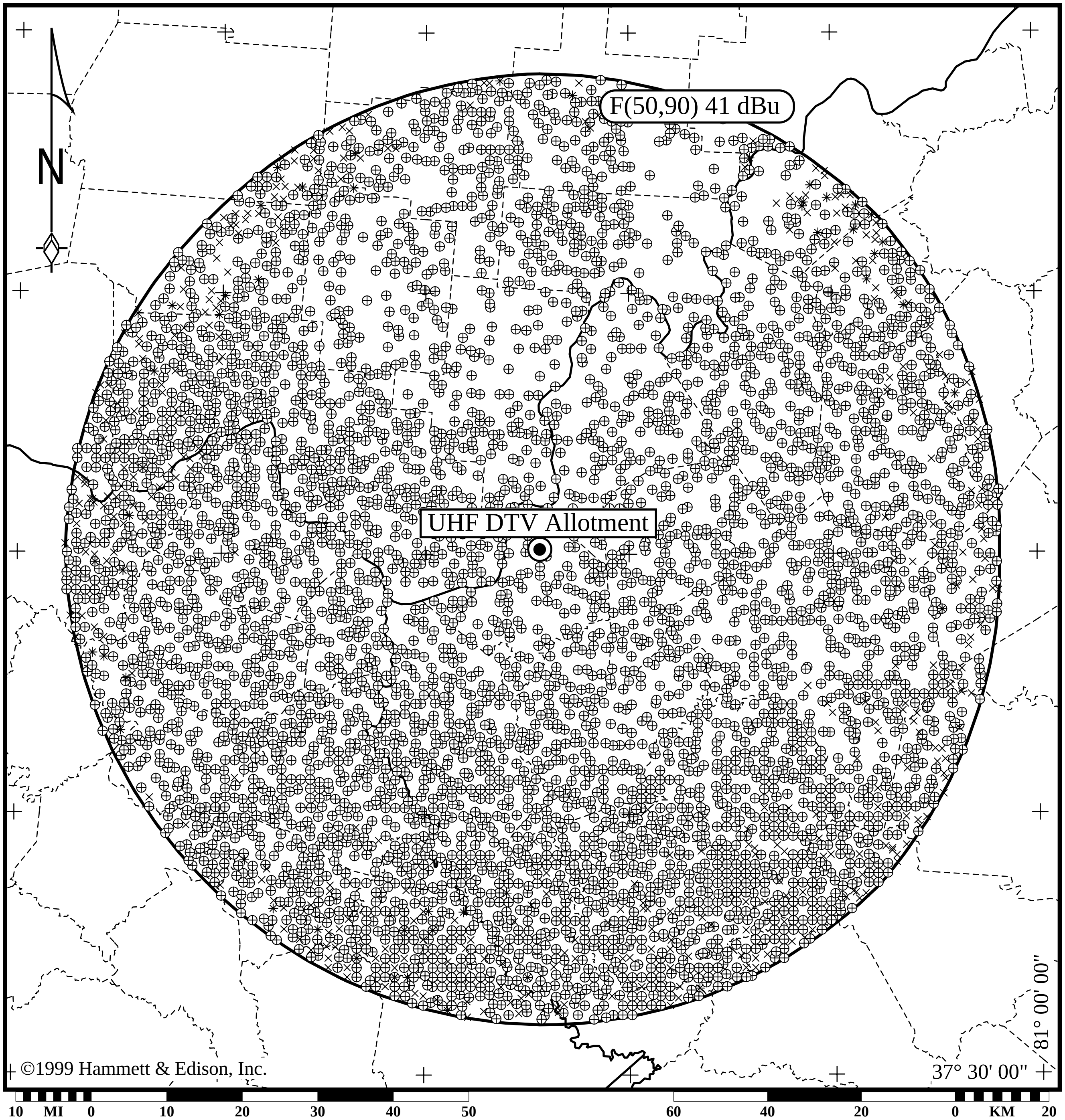
Lambert conformal conic map projection. Geographic coordinate marks shown at 30-minute increments.

×= No Signal (below threshold)
∗= Interference (with population in cell)
⊛= Interference (without population in cell)

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

990627
Figure 2A

OET-69 Coverage for West Virginia UHF DTV Allotment (with EC3 Cells)



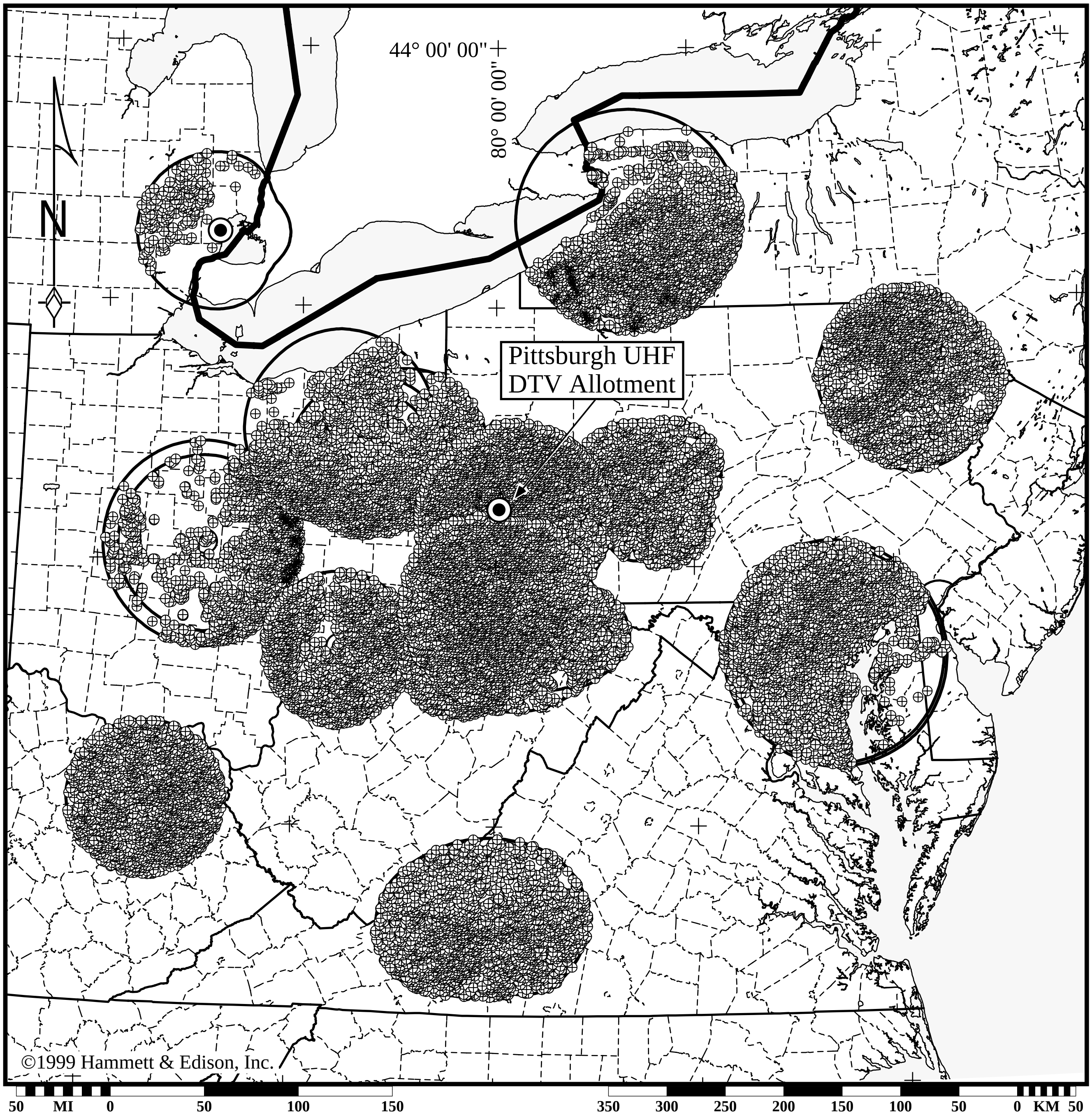
Lambert conformal conic map projection. Geographic coordinate marks shown at 30-minute increments.

×= No Signal (below threshold)
⁎= Interference (with population in cell)
⊛= Interference (without population in cell)
⊕= Longley-Rice error cell

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

990627
Figure 2B

OET-69 Interference Study for a Pittsburgh, Pennsylvania UHF DTV Allotment Showing Extent of EC3 Cells in the Protected Contours of Stations Close Enough to Require Study



Map data taken from Sectional Aeronautical Charts, published by the National Ocean Survey. Geographic coordinate marks shown at 120-minute increments.

×= No Signal (below threshold)
∗= Interference (with population in cell)
⊛= Interference (without population in cell)
⊕= Longley-Rice error cell

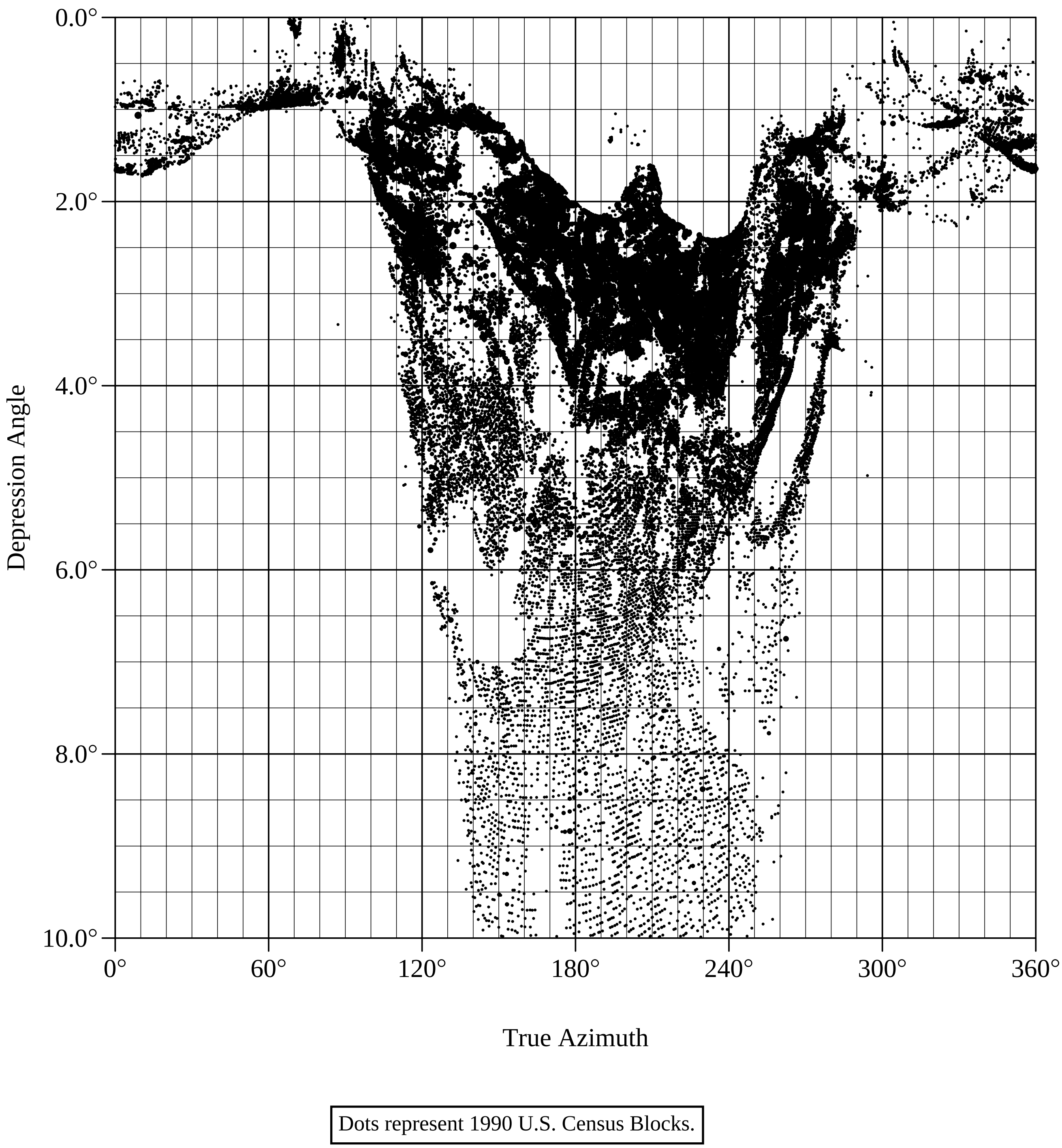
HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

990627
Figure 3

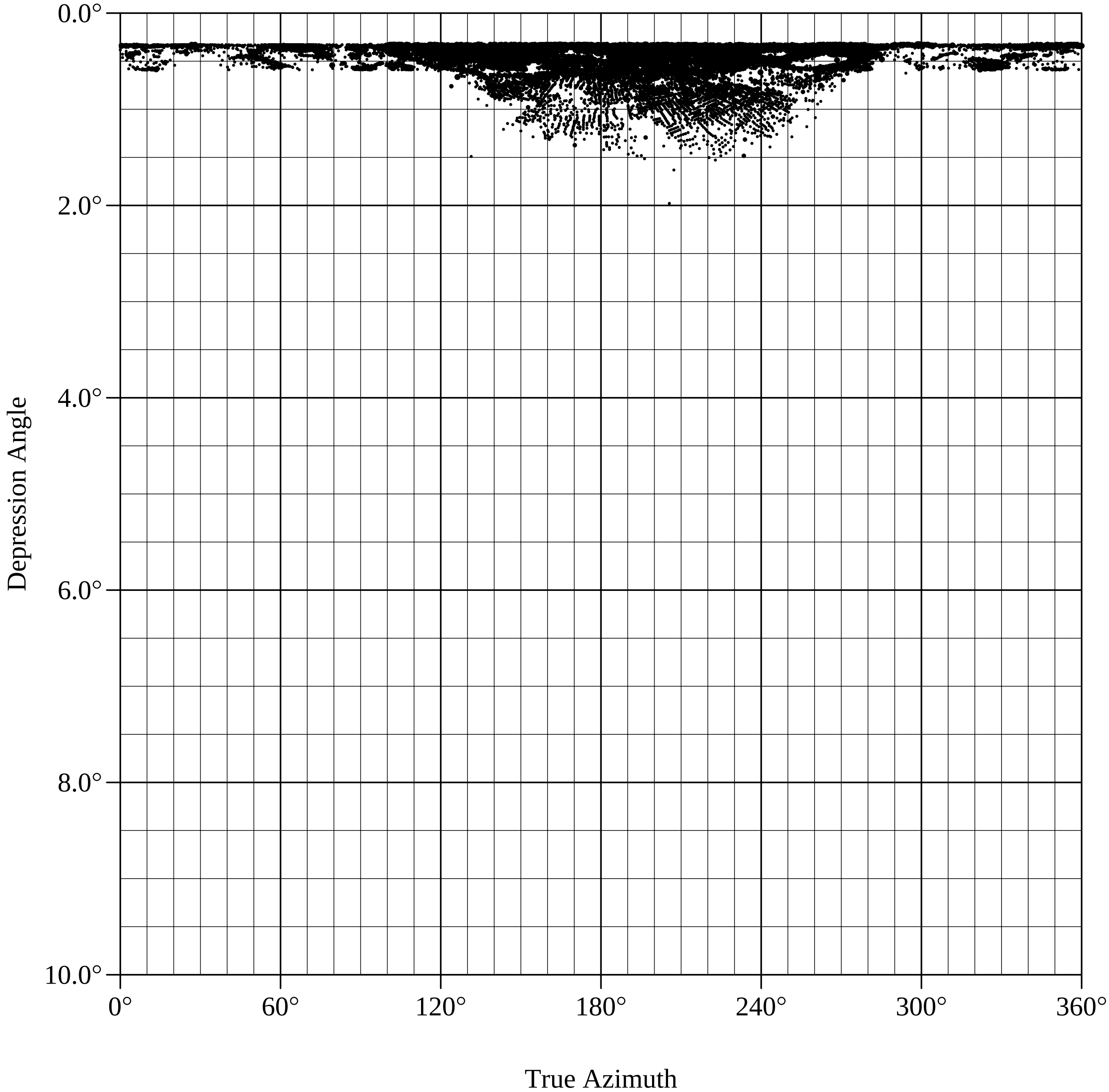
FCC Source Code Addressing Depression Angle Calculation Error Problem

```
c
c  Vertical radiation factor.  The tables prepared for the 6th R&O and
c  reconsideration orders used antenna heights AGL and forced the
c  transmitter height to be at least 30.0 meters.  Under mod4, these
c  heights are reckoned AMSL and there is no minimum.
c
           n_ant = NTSC
           if (sta_type(k) .eq. 'a') n_ant = ATV
           call antenna_tilt(k, az, vpat_bias)
           if (mod4 .and. .not. per_6th_order) then
              height = rcamsl_tmp
              rec_height = path_elev_pt(n_ter_pts) + rec_ant_hgt
           else
              height = max(30.0, rcamsl_tmp - path_elev_pt(1))
              rec_height = rec_ant_hgt
           end if
           instance = LONGLEY_RICE
           call gt_vert_rad_fac(height, rec_height, dtc, vpat_bias,
     &        instance, iband, n_ant, v_fac)
           if (v_fac .lt. 1.0) then
              v_log = flog10(v_fac)
              field = field + 20.0*v_log
           end if
```

Depression Angle vs. Azimuth to Population Centroids Within 160 km of Mt. Wilson Based on a COR Height of 1,817 m AMSL

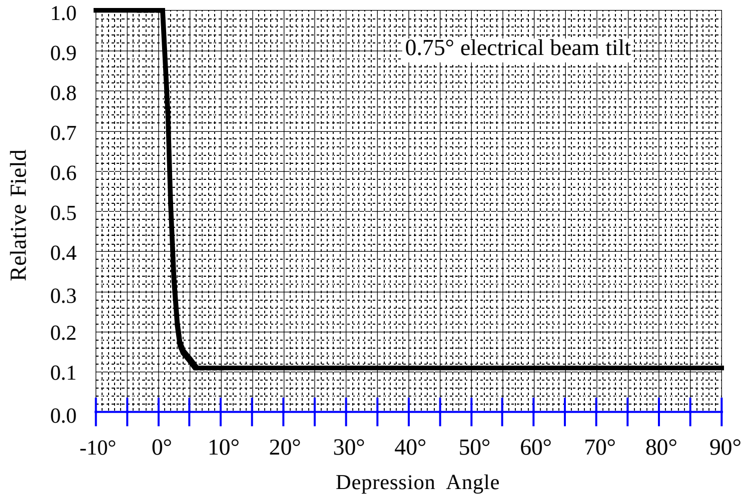


Depression Angle vs. Azimuth to Population Centroids Within 160 km of Mt. Wilson Based on Incorrect FCC Method

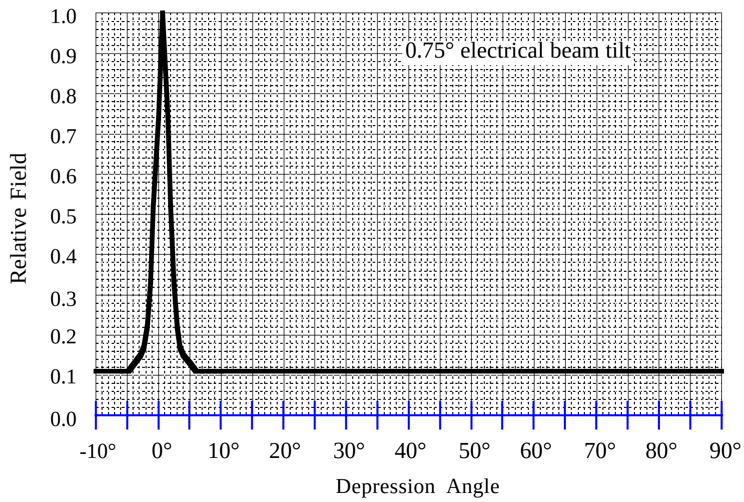


Dots represent 1990 U.S. Census Blocks.

OET-69 NTSC UHF Elevation Patterns: Flat vs. Symmetric

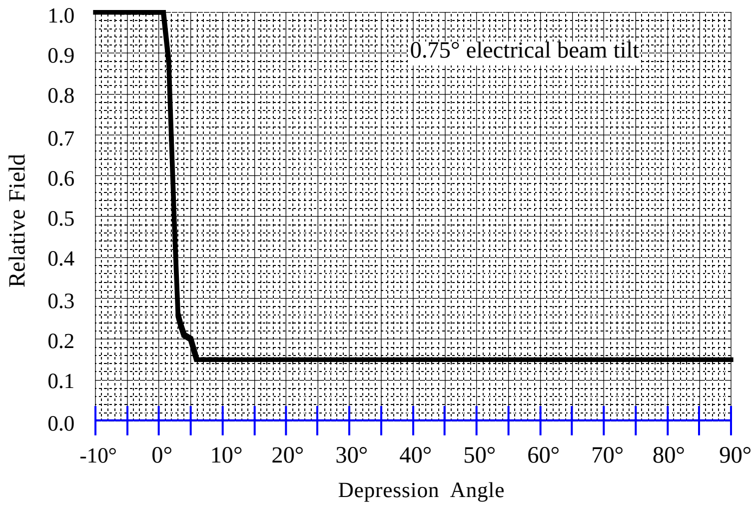


"FLAT"

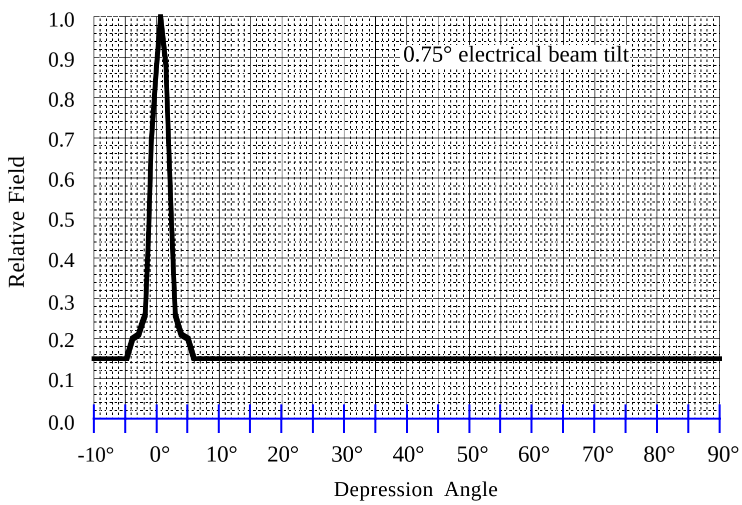


"SYMMETRIC"

OET-69 DTV UHF Elevation Patterns: Flat vs. Symmetric

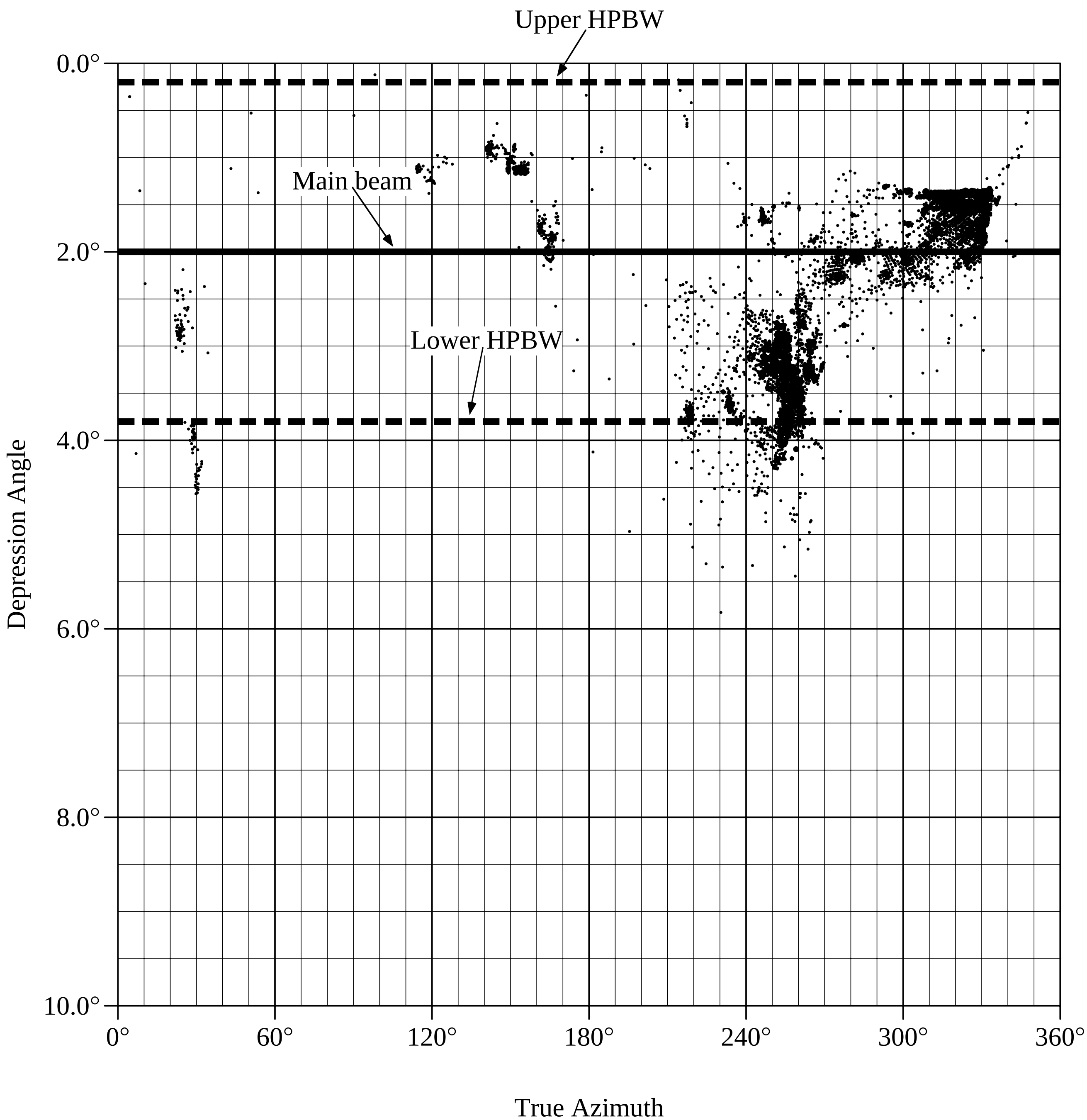


"FLAT"



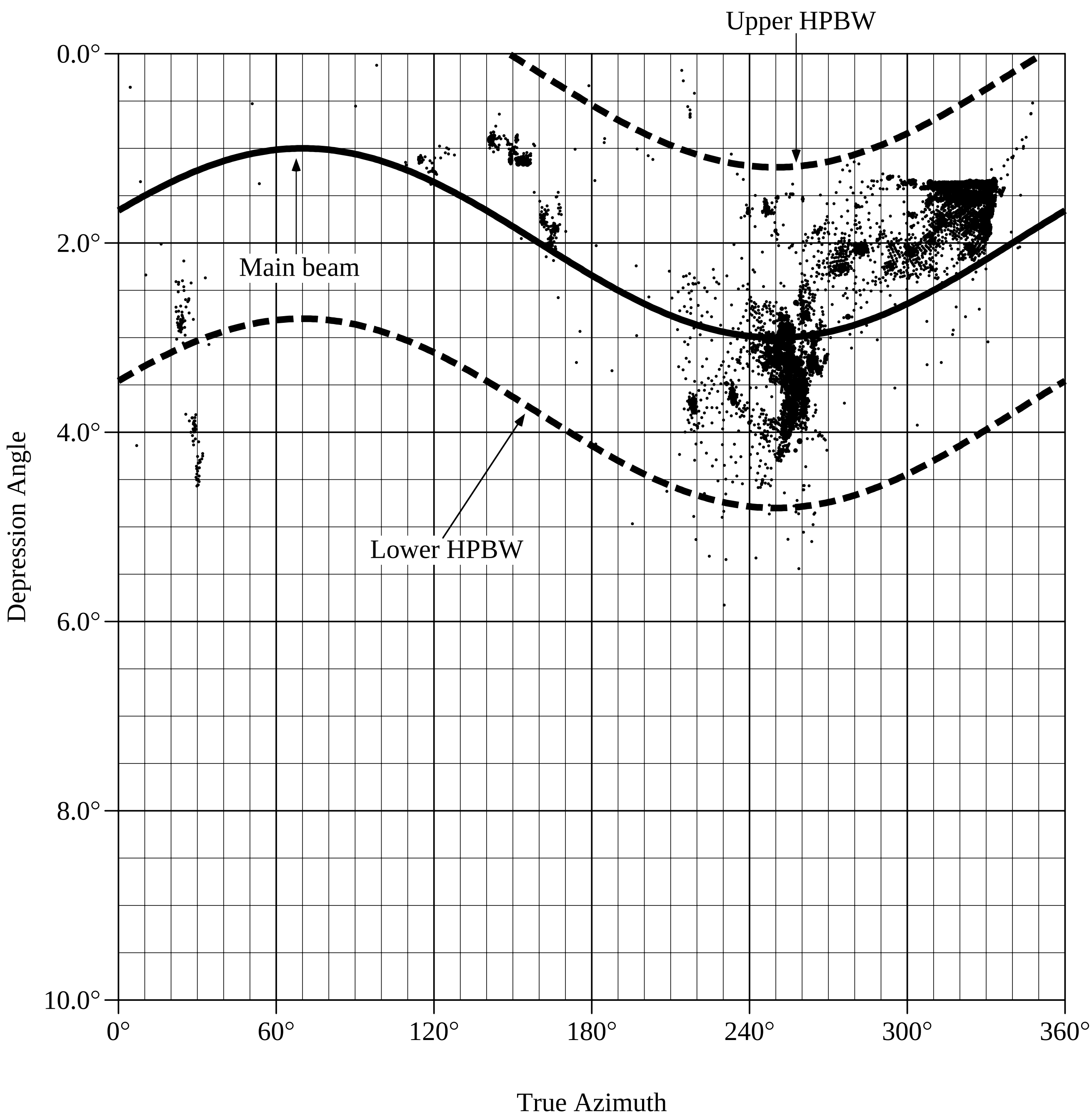
"SYMMETRIC"

Elevation Pattern Plot for 3.6-Degree HPBW Antenna with 2° of EBT



Dots represent 1990 U.S. Census Blocks.

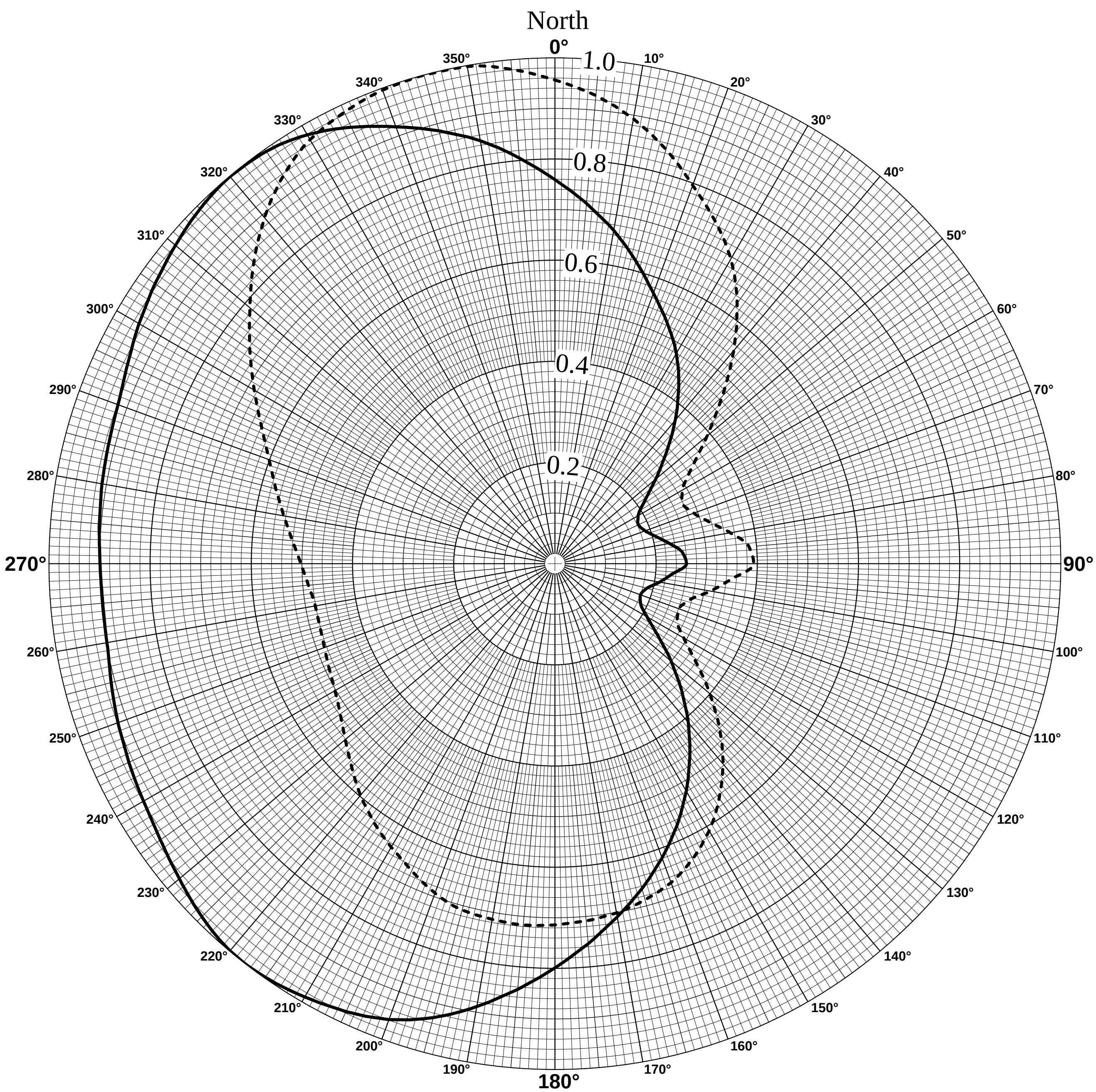
Elevation Pattern Plot for 3.6-Degree HPBW Antenna with 2° of EBT Plus 1° MBT Toward 250°T



Dots represent 1990 U.S. Census Blocks.

H&E Comments: MM Docket 87-268 • Biennial Review

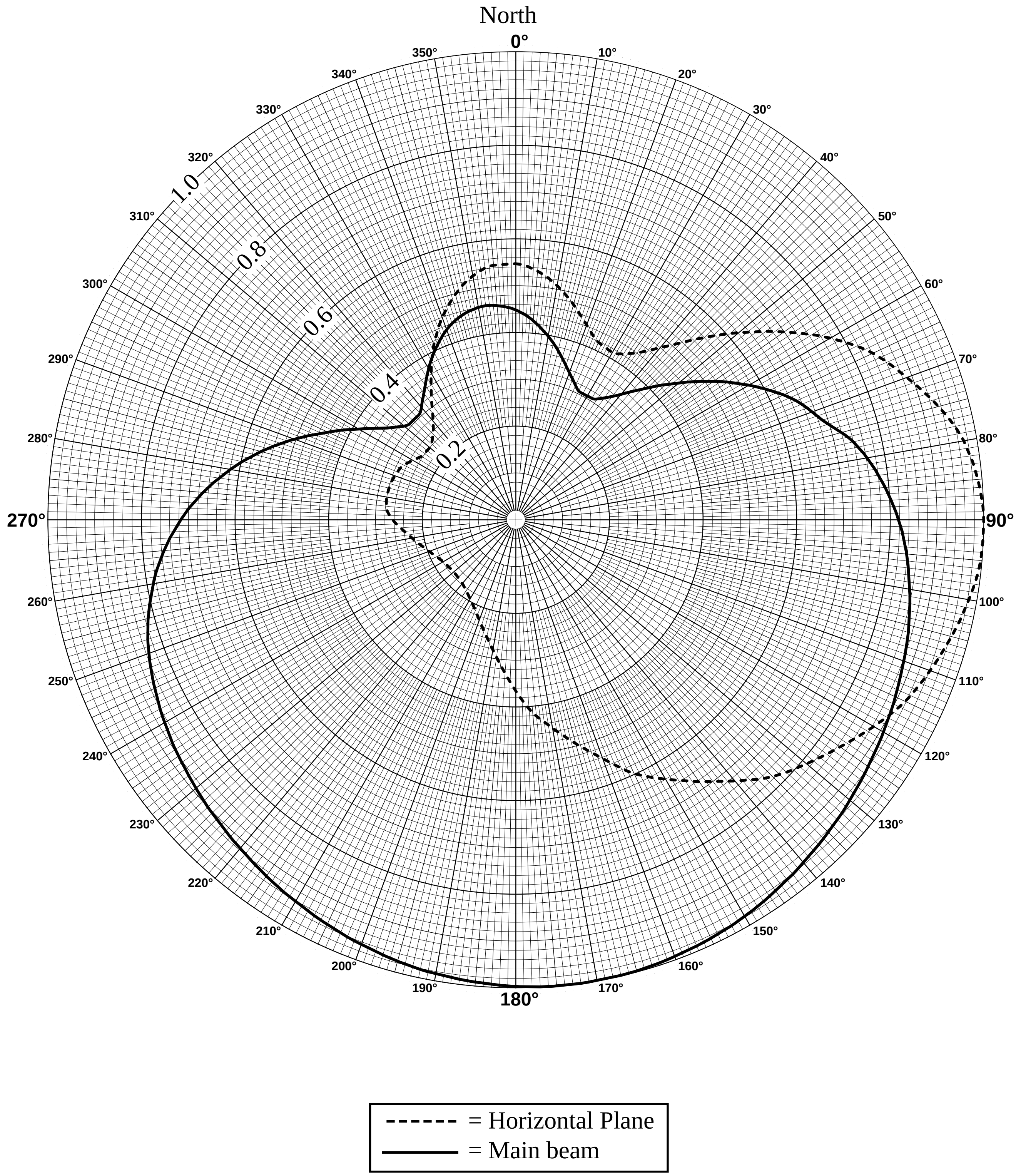
Comparison of Main-Beam and Horizontal Plane Azimuth Patterns for Station with 2° EBT Plus 1° MBT at 250°T - Relative Field -



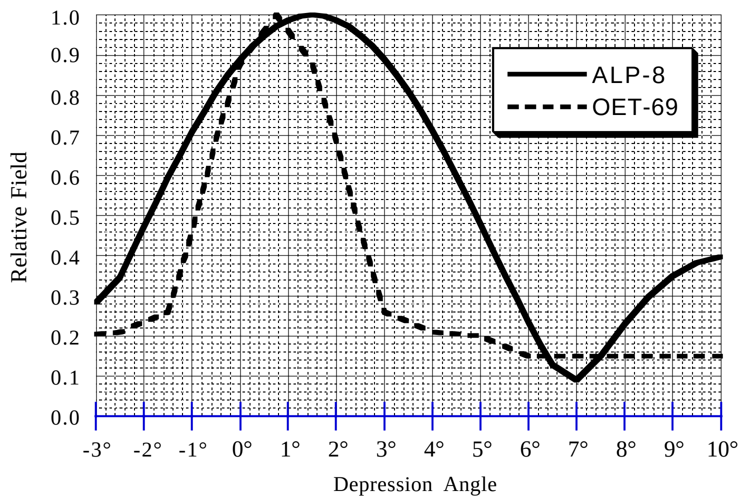
------ = Horizontal plane
——— = Main beam

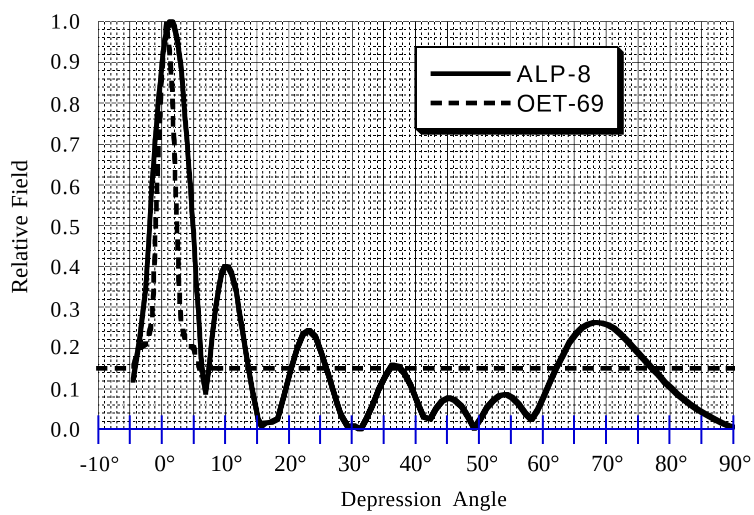
H&E Comments: MM Docket 87-268 • Biennial Review

Comparison of Main-Beam and Horizontal Plane Azimuth Patterns for Station with 1.6° EBT Plus 0.6° MBT at 225°T - Relative Field -



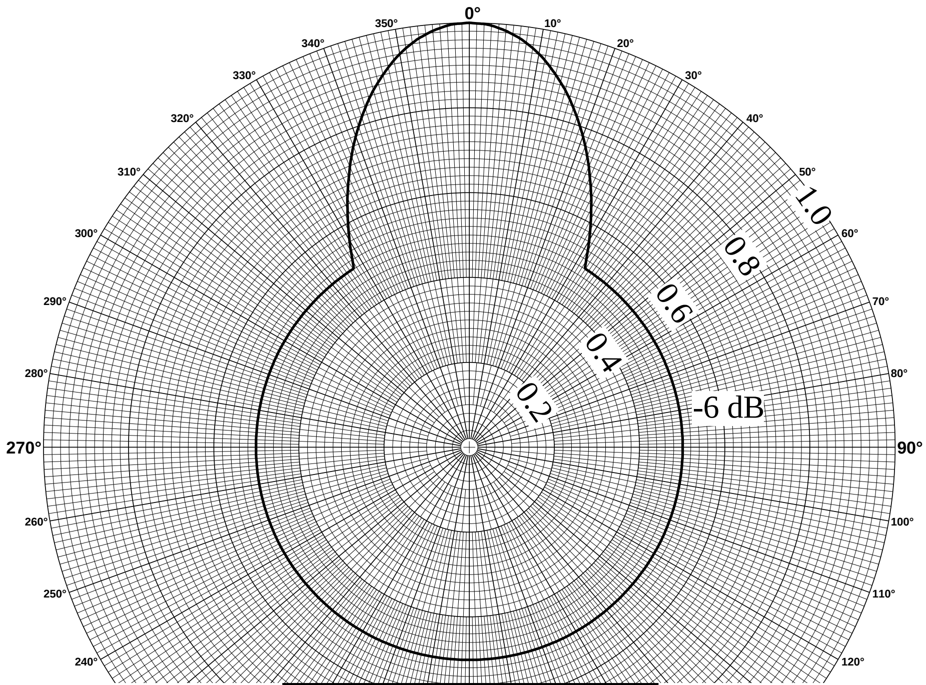
Comparison of ALP8 Elevation Pattern with 1.5° EBT to Symmetric Version of the OET-69 UHF DTV Elevation Pattern



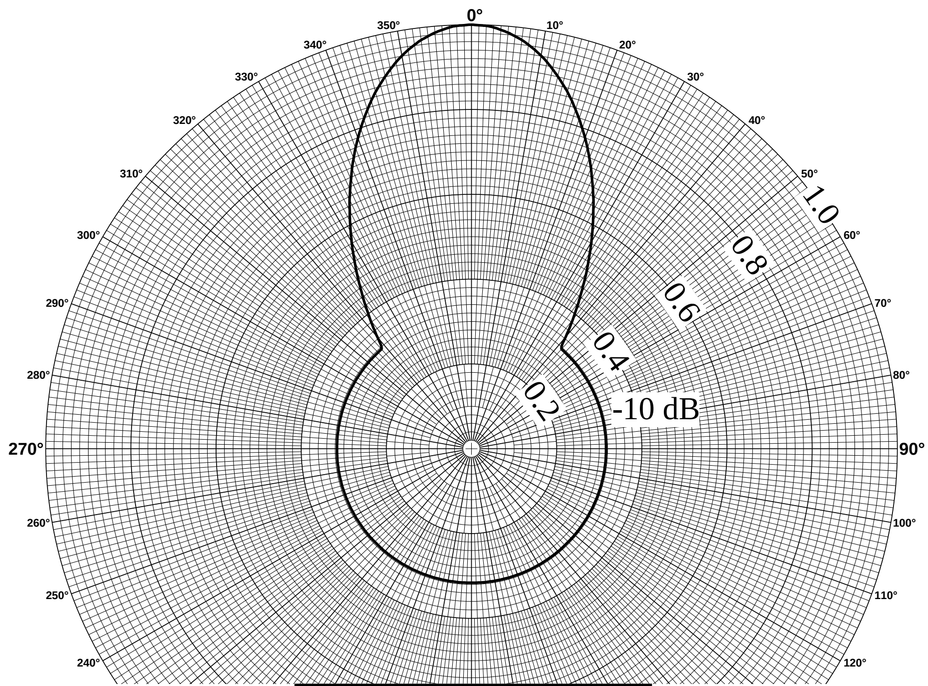


H&E Comments: MM Docket 87-268 • Biennial Review

Different Consumer Receive Antenna Patterns, as Assumed by FCC "Replication" Program to Develop DTV Allotments – Low-Band VHF –



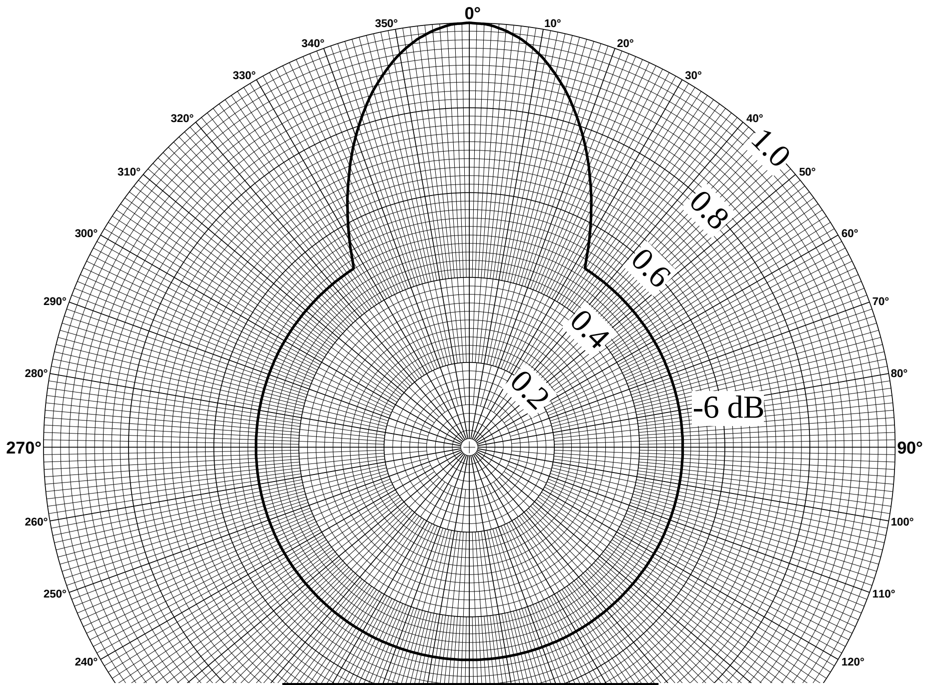
NTSC Receive Antenna



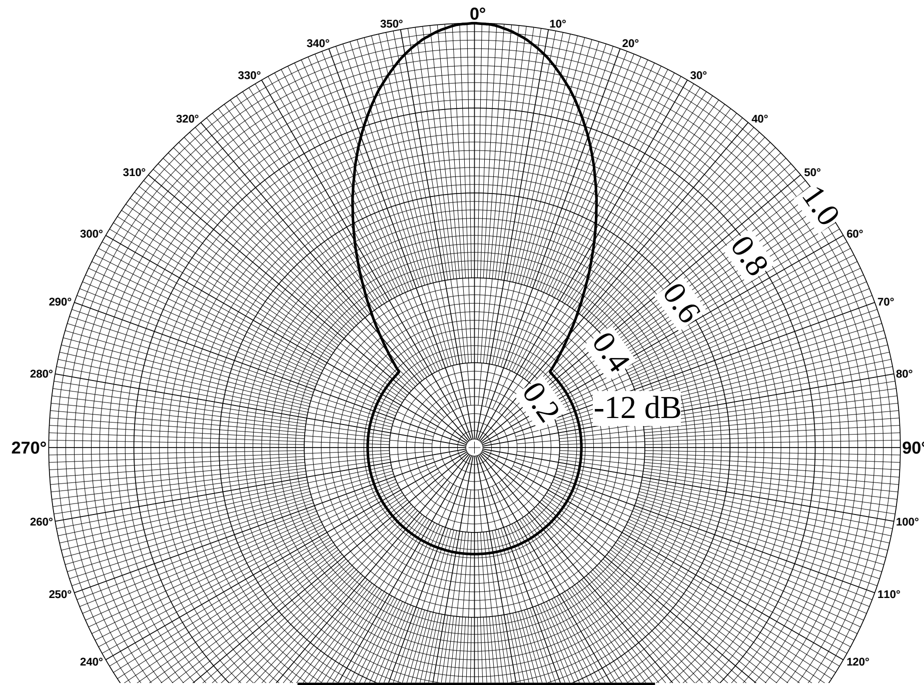
DTV Receive Antenna

H&E Comments: MM Docket 87-268 • Biennial Review

Different Consumer Receive Antenna Patterns, as Assumed by FCC "Replication" Program to Develop DTV Allotments – High-Band VHF –

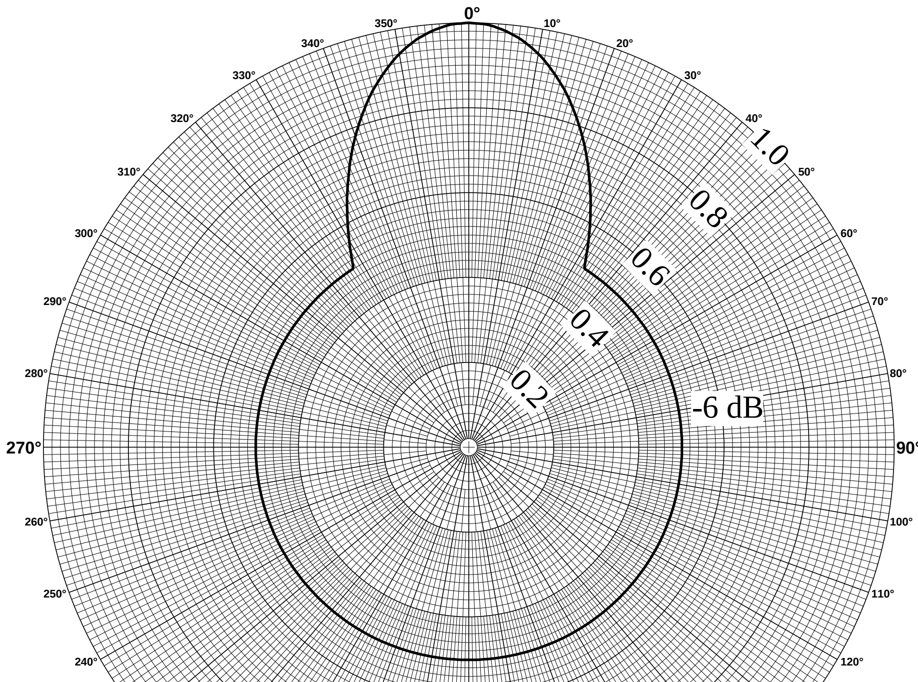


NTSC Receive Antenna

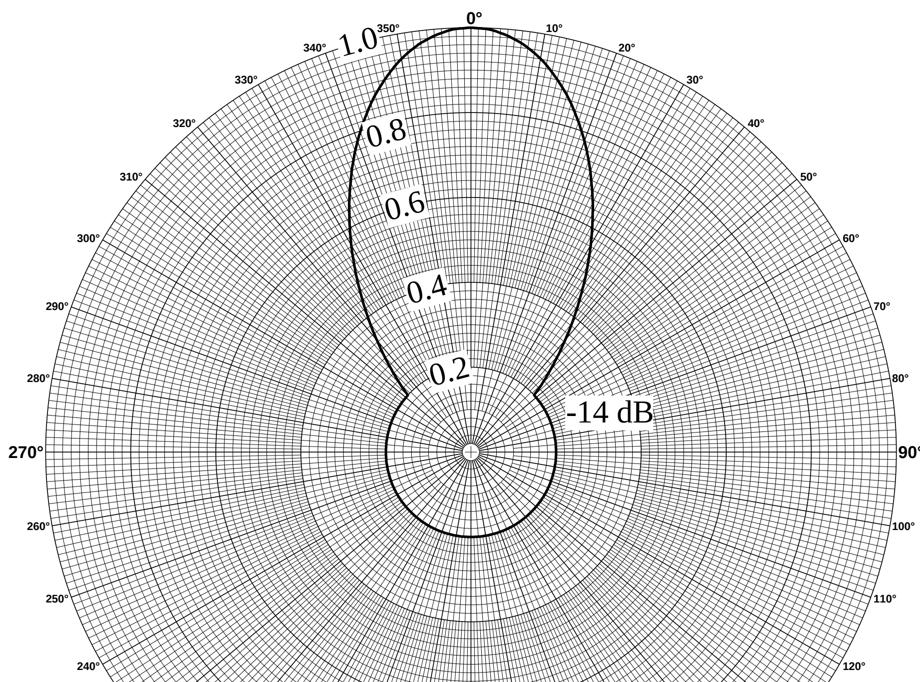


DTV Receive Antenna

Different Consumer Receive Antenna Patterns, as Assumed by FCC "Replication" Program to Develop DTV Allotments
– UHF –

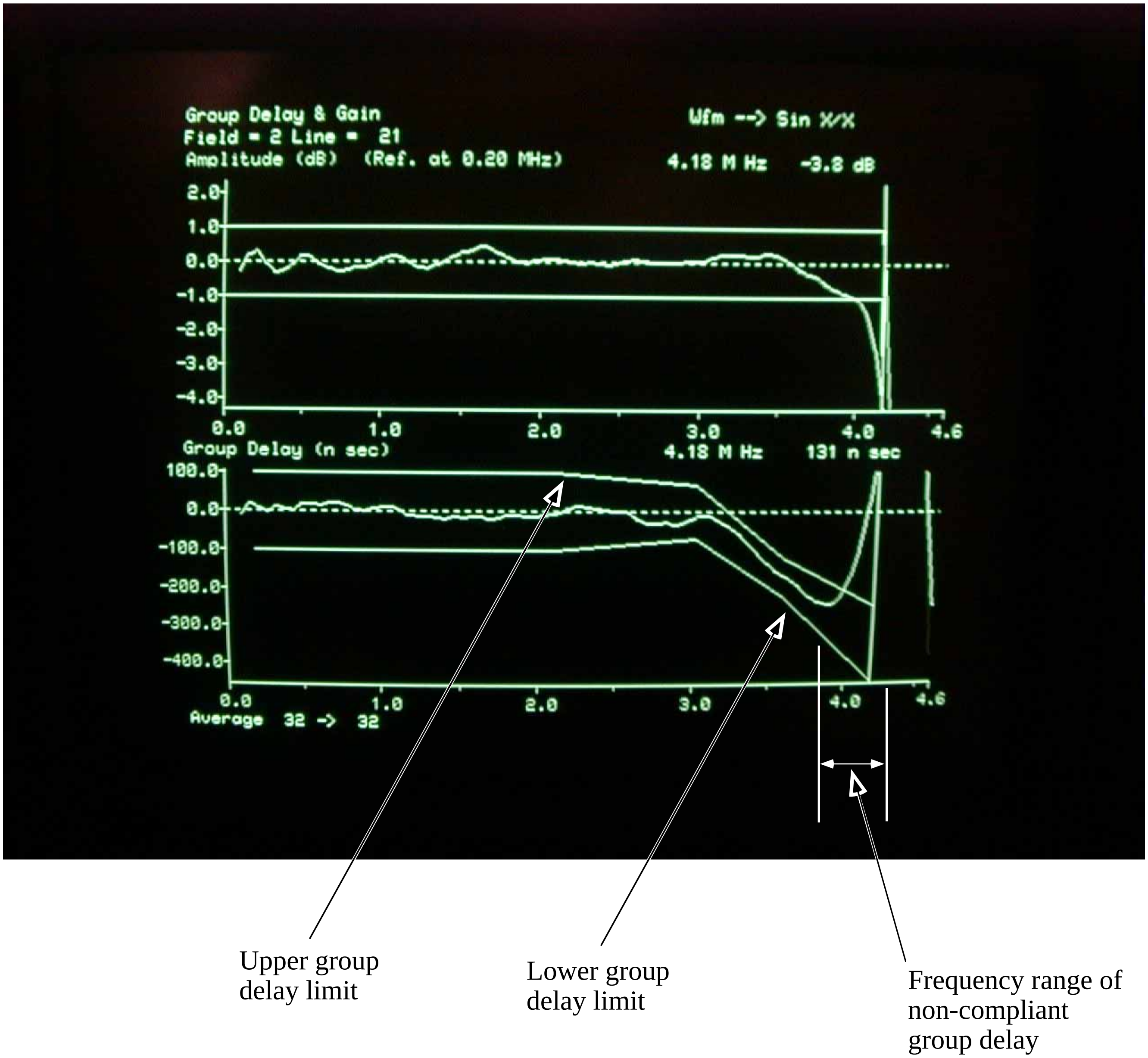


NTSC Receive Antenna



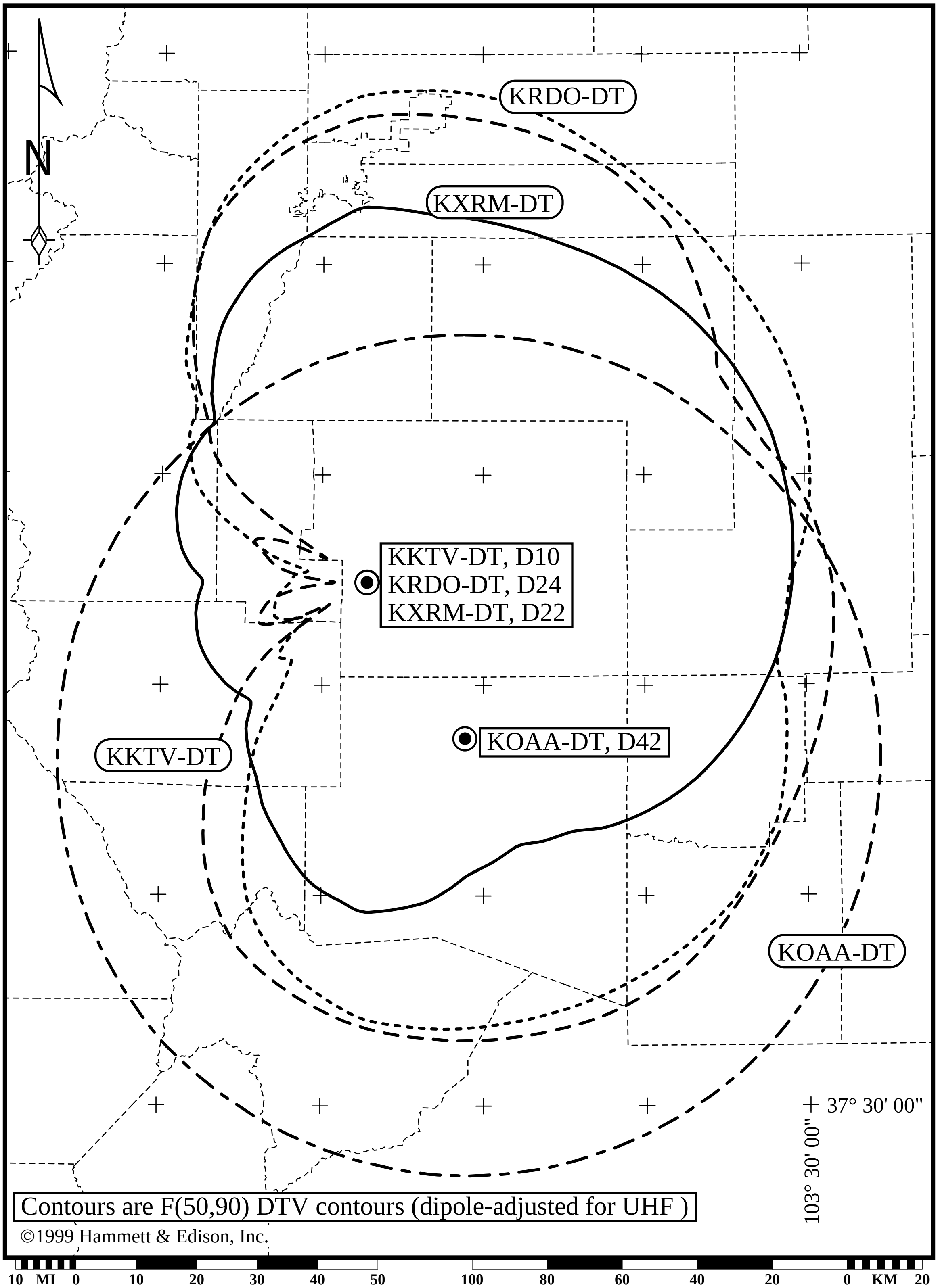
DTV Receive Antenna

Group Delay Measurements on New NTSC Transmitter with N+1 DTV Channel Common Transmission Line and Antenna



Group delay measurements on new NTSC UHF-TV transmitter operating into N+1 channel combiner.

Colorado Springs-Pueblo TV Market
DTV Coverage Contours



Albers equal area map projection. Geographic coordinate marks shown at 30-minute increments.

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO